Biological Conservation 191 (2015) 700–706

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/bioc

Short communication

Diver towed GPS to estimate densities of a critically endangered fish

Tim Lynch *, Mark Green, Claire Davies

CSIRO Oceans and Atmosphere, Castray Esplanade, TAS 7000, Australia

ARTICLE INFO

Article history:
Received 5 May 2015
Received in revised form 3 August 2015
Accepted 5 August 2015
Available online 2 September 2015

Keywords:
Spotted handfish
Sparse target
Rare fish
GPS

ABSTRACT

Spotted handfish are a critically endangered anglerfish. Monitoring of the species has, in the past, been undertaken *via* underwater visual census (UVC) parameterised with fixed length 100 m × 3 m strip transects measured with reel lines. However, the sparse distribution and cryptic nature of handfish resulted in low statistical power to track populations through time. To achieve reasonable confidence of detecting change ~40 transects are required for density estimates, making the logistical constraints of monitoring onerous. We trialled a new survey method for UVC at one study site with a known local population of fish, replacing reel transects with variable length strip transects parameterised with a diver towed Global Positioning System (GPS) float. From 18 transects we determined a density of 24 (±3.5) handfish per hectare, but bootstrapping suggested little improvement in precision occurred after 8 transects. Modelling these results to previous estimates at the site indicated that our GPS float approach required many fewer transects and dives to determine 50% increases or decreases in fish densities. This improvement was partly due to the better sampling efficiency; with 3 times the average search area per transect but was also a result of longer transects being a better solution for monitoring a sparse population. Our results returned a normal sample distribution of fish counts with few zeros and many multiple observations, which differed to the original approach which was heavily skewed towards zero observations per transect. However, at very low population densities even this more robust solution will require many samples to detect change. Our GPS parameterized surveys also improved the functionality of observing fish behaviour as we could accurately plot fish allowing for detailed investigation of distributions. When fish were observed they were also bi-laterally digitally photographed to record their unique natural markings. By synchronising the photographs timestamp with the GPS clock, we were able to geo-locate individual recaptures and our preliminary results suggests net movements were limited. This new approach increases the logistical feasibility for monitoring spotted handfish and may have applications for other sparsely distributed benthic species.

Crown Copyright © 2015 Published by Elsevier Ltd. All rights reserved.

1. Introduction

Handfish are an anglerfish of the family Brachionichthyidae; distributed from central eastern Australia to the Great Australian Bight. The waters of the island state of Tasmania are particular rich in this fauna, containing all but three of the 14 described species (Last and Gledheill, 2009). One species, the spotted handfish, *Brachionichthys hirsutus*, has in recent times been the subject of considerable conservation concern as it appears to vulnerable to extinction (Green and Bruce, 1998; Bruce et al., 1998, 1999). A small, cryptic and demersal species, *B. hirsutus* has both a narrow depth (1–60 m) and geographic distribution (Bruce et al., 1998). Once widespread across eastern Tasmanian, from Coles Bay (42° 06′ S, 148° 09′ E), to the D'Entrecasteaux Channel (42° 09′ S, 147° 04′ E) (Last et al., 2007), known local populations of spotted handfish are now restricted to the Derwent estuary (Fig. 1a). As their name suggests, handfish prefer to 'walk' over the substrate rather than swim, which when combined with their lack of a pelagic larval stage means they are thought to have poor dispersal (Last et al., 2007).

Handfish and their habitats have been subject to extensive disturbance through dredging for the commercial scallop (*Pecten fumatus*), (Bruce et al., 1998, 1999, Last and Gledheill, 2009). The scallop fishery started in the Derwent estuary in the late 1800's but by 1925 had collapsed and effort transferred south to the D'Entrecasteaux Channel, before collapse in 1967 (Edgar and Samson, 2004). The fishery had moved across all other parts of the spotted handfishes' distribution by around 1955. Perhaps due to the timing of this fishery succession, remnant populations of *B. hirsutus* remained common in the Derwent estuary in the latter half of the 20th Century (Edgar et al., 1982; Last, 1983), after disappearing from other parts of their historical distribution.

More recently the remnant population in the Derwent became severely depleted (Barrett et al., 1996) which occurred at the same time as the estuary was infested by North Pacific seastars (*Asterias amurensis*). This marine pest was first observed in 1986 in the port of Hobart (Turner, 1992) and by 1995 had spread across most of the historic geographic range of spotted handfish (Byrne et al., 1997). A generalist predator, *A. amurensis*'s prey includes the invertebrates used as

* Corresponding author.
E-mail address: Tim.Lynch@csiro.au (T. Lynch).

http://dx.doi.org/10.1016/j.biocon.2015.08.009
0006-3207/Crown Copyright © 2015 Published by Elsevier Ltd. All rights reserved.

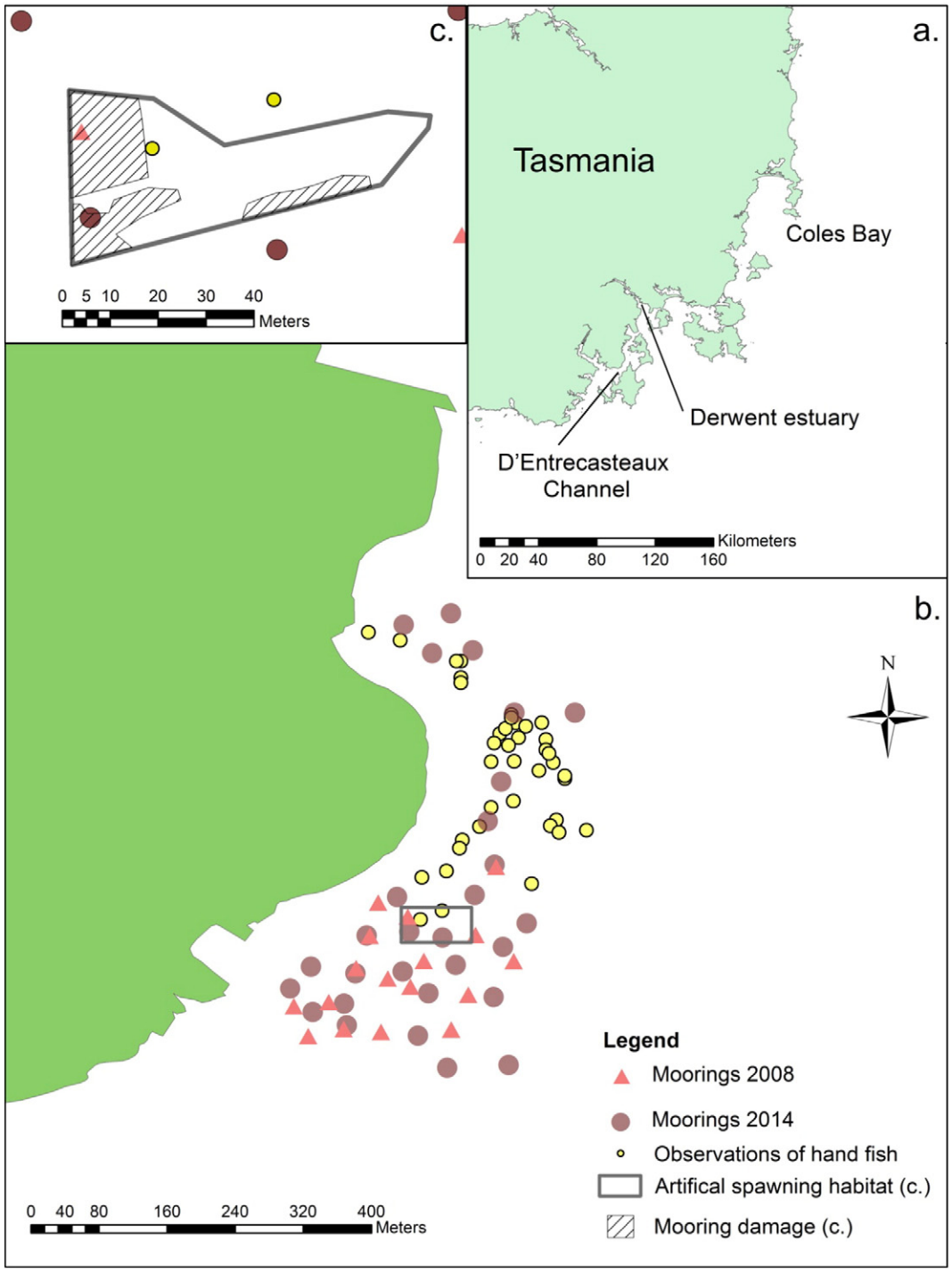

Fig. 1. (a) South east Tasmania, Australia (b) distribution of all spotted handfish observed at the study site in 2014 (small circles) and mooring surface signatures both from 2008 (triangles) and additional moorings observed in 2014 (large circles). Insert (c) shows the boundary area of the artificial spawning habitat array, cross hatched areas were impacted by yacht mooring chains.

spawning habitat (Ross et al., 2002) by the directly recruiting *B. hirsutus* such as the stalked Holozoid ascidians, *Sycozoa* spp., (Bruce et al., 1997; Bruce and Green, 1998). To counter this threatening process, previous recovery actions have included placement of arrays of artificial spawning habitat (Green et al., 2012). The Derwent estuary is also an urbanised, polluted and disturbed system (Bloom and Ayling, 1977), with ribbon development of Tasmania's largest city (ABS, 2013) and many near shore areas being used for yacht moorings.

This combination of historical and current stressors has led to *B. hirsutus* listing as Critically Endangered on the Australian government's Environment Protection and Biodiversity Conservation Act (Department of the Environment (DotE), 2015) and the International Union for Conservation of Natures Red List of Threatened Species (Bruce and Last, 1996). Surveys suggest the Derwent estuary now host just nine local populations (Green, 2007).

This history of impacts, resulting in low densities of fish, combined with their small, cryptic nature presents a challenging sampling problem. From 1996–1997 several methods were assessed to develop a monitoring protocol (Bruce et al., 1997; Bruce and Green, 1997; Green and Bruce, 1998) but it soon became clear that considerable effort was required to achieve even a low power to detect change (Haskard, 1997). The monitoring method chosen was underwater visual census (UVC)

Download English Version:

https://daneshyari.com/en/article/6299097

Download Persian Version:

https://daneshyari.com/article/6299097

Daneshyari.com